DOCUMENT RESUME

ED 384 596 SP 036 094

AUTHOR McNamara, Suzannah; Pedigo, Michelle L.
TITLE Development of an Individualized Computer Training Model for Classroom Teachers.
PUB DATE May 95
NOTE 91p.
PUB TYPE Reports - Research/Technical (143) -- Tests/Evaluation Instruments (160)

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS Computer Anxiety; Computer Attitudes; *Computer Literacy; Computers; Elementary Education; Elementary School Teachers; *Faculty Development; *Individualized Instruction; *Inservice Teacher Education; Skill Development; *Teaching Models; *Training Methods

ABSTRACT

This study was designed to develop a practical, effective model of computer training for classroom teachers. The hypothesis was that a model of computer training which is highly individualized, provides hands-on learning, and occurs in stages would be successful in increasing the skill and comfort level of teachers. The study occurred in an elementary school (K-5) in a semi-rural area of central Virginia and included a sample of six teachers from a variety of grade levels who needed basic computer instruction. Two individualized training sessions and one follow-up session were offered for each teacher based on pre-assessed needs. The training occurred during regular school hours, an arrangement made possible by providing teachers with substitutes for their classrooms. Quantitative and qualitative data revealed an increase in teachers skill and comfort levels using the computer and a strong teacher preference for this type of individualized training. Appendixes contain the pre- and post-assessment instruments, training evaluation form, sample lesson plan, and class schedule. (Author/ND)

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Development of an Individualized Computer Training Model for Classroom Teachers

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ABSTRACT

This study was designed to develop a practical, effective model of computer training for classroom teachers. It was our hypothesis that a model of computer training which is highly individualized, provides hands-on learning, and occurs in stages would be successful in increasing the skill level and comfort level of teachers. The study occurred in an elementary school (K-5) in a semi-rural area of central Virginia and included a sample of six teachers from a variety of grade levels who needed basic computer instruction. Two individualized training sessions and one follow-up session were offered for each teacher based on pre-assessed needs. The training occurred during regular school hours by providing teachers with substitutes for their classrooms. Quantitative and qualitative data revealed an increase in teachers' skill and comfort levels using the computer and a strong teacher preference for this type of individualized training.

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INTRODUCTION

In the world today, the prevalence and importance of technology is increasing rapidly, thus creating a demand and expectation that students be computer literate. As a result, schools are including technology in the curriculum and significantly increasing the number of computers available to students and faculty at an enormous rate (Wepner, 1986). In fact, school districts are choosing to spend a great portion of their discretionary funds to purchase new computers and software for student and teacher use (Becker, 1992).

In a study done in 1992, Linda Ehley cites evidence that nearly two million computers exist in classrooms across the nation. She states that "the ratio of students to computers has fallen from 125 students for each computer in 1983-84 to 22 students per computer in 1989-90." According to Becker (1991), over the last few years, approximately 300,000 to 400,000 computers have been added to U.S. schools each year and the number of computers in the classroom continues to climb every day.

With the rise in the number of computers, a rise in the importance of computers in the home, schools, and workplace has occurred. It is difficult to find a job without some basic computer knowledge and will be increasingly hard to do so in the future. In today's world, a lack of computer skills might be compared to a lack of basic subject knowledge such as reading and mathematics.

Employees must know applications such as word processing, databases, spreadsheets, and electronic mail. It is necessary for students to learn these skills in school in order to be prepared to enter the work force (Piotrowski, 1992). However, students cannot learn about computers unless they have teachers that are knowledgeable about technology. Yet, while computers are abundant in schools, a majority of teachers do not have the background knowledge they need to use them effectively. The question thus presents itself: How can schools provide teachers with effective computer training?

Many models of computer training have been tested in the past. Based on teacher responses, some have been very effective and others, extremely ineffective. The Literature Review section will discuss the current technology needs of teachers and evaluate the effectiveness of past models. As supported in our research, it is our hypothesis that a model of computer training that is highly individualized, provides for hands-on learning, and occurs in stages will be effective in improving the skill levels and comfort levels of classroom teachers.

Thus, we developed such a model of training and tested our hypothesis by conducting a study which provided elementary school teachers with computer instruction. During the study, we collected quantitative and qualitative data concerning the teachers' skill levels, comfort levels, and overall evaluation of the training. In the Methods section of this paper, we will explain the steps taken in

developing and testing our hypothesis. Next, in the Results section, we will report the findings of our study and then, in the Conclusions and Discussion section, we will examine implications for these results. Finally, we will offer recommendations for future training and research.

LITERATURE REVIEW

There is an abundance of research concerning computer education and training for teachers. In an attempt to identify aspects of an effective model of computer training, we will examine the rationale, the methods of instruction, and the results and conclusions found in studies previously done.

TEACHER KNOWLEDGE AND ATTITUDES ABOUT COMPUTERS

The main goal for schools and teachers is to give their students the most effective education possible. Providing students with the best education today includes offering students the finest experiences using computers. However, even in schools with a moderate number of computers, many teachers are unprepared to incorporate the computers into their curriculum or to instruct their students in the use of computers (Piotrowski, 1992; Stecher & Solorzano, 1987). It is illogical, as Stecher (1987) notes in his study, that "we are asking computer-illiterate teachers to help students become computer literate at a functional level." If teachers are not literate in basic computer skills, they cannot even begin to integrate computers into the classroom.

Teachers lack computer knowledge because, unfortunately, most existing teachers were not trained in computer technology in college and have not received any such training during their teaching career (Piotrowski, 1992). In fact, reports suggest that two-thirds

of all K-12 teachers have had less than ten hours of computer training (Barker, 1994). However, technology is constantly changing and in order for teachers and students to be knowledgeable about the technology and use it effectively, they need continuous training (Becker, 1992; Turkel & Chapline, 1984).

Although many teachers have not been exposed to computers before, studies have found a high interest level in teachers toward computers. For example, Wepner (1986) discovered that although less than half of her teacher respondents had been exposed to any training in computer usage, many of those teachers desired to take a computer course. Forty-five percent of her respondents said they would definitely be interested in taking a course in computer education and thirty-six percent indicated they would possibly be interested in such a course. While most school personnel would agree that lack of training is the major factor that prevents the effective use of educational technology, the majority of school districts are not investing sufficient funds in computer education for teachers.

COMPUTER EDUCATION FOR TEACHERS

Despite the educational community's generosity in purchasing computers, it generally has not been willing to devote the necessary funding to provide computer training for teachers and to hire computer resource teachers (Barker, 1994). This is unfortunate since it has been found that schools who are effectively using

available technology are in districts which allocate a fair amount of money to staff development and support (Becker, 1992).

Currently, teachers are provided with some training through in-service sessions, but many computer training in-service days have been shown to be relatively inefficient for a number of reasons. First of all, the in-service sessions are typically infrequent, since there are usually only a handful of in-service days in a school year. Also, the sessions are usually conducted by people who are not educators, therefore not providing many opportunities for exploring instructional applications. Also, the groups are generally too large and far too heterogeneous to possibly be able to meet the varied needs of teachers on different skill levels and comfort levels. Finally, and most importantly, however, these types of training sessions usually do not provide any type of follow-up support for teachers. Teachers are sent back to their schools or classrooms and rarely offered a chance to practice what they learned in the sessions and ask questions (Stecher & Solorzano, 1987).

Considering the inefficiencies of in-service training, it is difficult to justify the expense of them. With the rapid growth of computers in the schools and budget concerns in mind, schools will be forced to look away from expensive, traditional one-day training sessions conducted by professionals in the computer field, to more cost effective non-traditional resources that can be found within the community.

For example, a school district in West Virginia has developed a creative program called Project TEACH which brings community businesses into the classroom to teach skills that children will need in the workplace, while offering release time for the classroom teacher to go to computer in-service training sessions. The logistics of this type of plan were not easy to work out, but the effort put into making the project work has enabled teachers to gain release time for training that the county previously could not afford (Cowan, 1989). This project shows that by taking advantage of community resources, school districts can provide effective training sessions for teachers at a minimal cost. Other successful training sessions have occurred by pairing in-service teachers who can share their experience in technology, with pre-service teachers who can share their experience in the classroom. Together, they can find effective means of integrating computer usage into the classroom (Ehley, 1992).

EFFECTIVE MODELS OF TRAINING

In order to make optimal use of the minimal funding that is provided, school districts must know which features of training sessions that have been done in the past have been the most effective. For this reason, many studies have been done that have explored effective time frames, models of instruction, and content areas for computer training sessions. According to these studies, effective models of training are ones that decrease anxiety, are

highly individualized, are practical and hands-on, and occur in stages. We will now explore each of these components in more detail.

Reducing Teacher Anxiety

It has been found that teacher anxiety has been a determining factor in the lack of adoption of computer use in the schools (Woodrow, 1992). One key component of training, therefore, must address the task of improving teacher attitudes toward computers by increasing their skill levels and comfort levels. Teachers who might otherwise be very excited about the use of technology in their classrooms too often suffer from anxiety and fear when it comes to the use of computers (Barker, 1994). For example, one computer resource teacher describes his role in the school as that of a medical doctor. He lists a variety of phobias from which new computer users suffer and he describes how he tries to alleviate the symptoms of these phobias through personal contact and training. Among the list of phobias are "Misoneism," the hatred and fear of change, "Computerphobia," the fear of computers, and "Technophobia," the fear of technology (Bailey & Ross, 1994).

Barker (1994) found in her study that despite a strong desire to learn more about computers, teachers who did not feel adequately prepared to use computers effectively in their classrooms rarely used computers at all in the curriculum. As well as decreasing the amount of computer usage in the classroom, teacher attitudes toward computers can affect student achievement in technology.

Students taught by a teacher with a positive outlook on computer usage demonstrated a higher level of achievement in technology (Barker, 1994).

The first step in decreasing computer anxiety in teachers, Piotrowski (1992) suggests, is being patient and understanding when dealing with beginning computer users. Stecher and Solorzano (1987) found in their study that trainers who maintained a friendly and comfortable atmosphere, where the trainees were not intimidated by the complexity of the subject matter, were very well received by classroom teachers. Also, by providing teachers with a bank of skills from which to draw, their anxiety level naturally decreased as they became more familiar with computers (Stecher & Solorzano, 1987).

Overall, teachers have shown enjoyment and enthusiasm for computer training. School administrators have said that it is very common for teachers to relay positive messages to them about training opportunities (Stecher & Solorzano, 1987). Teachers did feel, however, that training sessions could be improved. For example, teachers felt that participation in such training should be on a voluntary basis (Barker, 1994). The response to the training conducted by Stecher and Solorzano was very positive for those who participated voluntarily but not as positive for those who were required to participate in the training (Stecher & Solorzano, 1987). Another finding is that in addition to training sessions, teachers should be a part of a social network of computer users. The network

can either be comprised of experts who have already mastered the technology or a "community of teacher-learners" who combine their efforts and successes in learning the technology. This network offers additional support and training to teachers who might need it (Becker, 1992).

Since computer usage among teachers is highly reliant on attitudes toward technology, improving teachers' comfort level with computers is key to increasing effective applications of computers in the classroom. As Ehley (1992) eloquently states,

> The most critical element in establishing a computer plan in a school is not the hardware or the software, but the HEADWARE. The headware, or positive mind set, can be achieved only when people find the microcomputer familiar and comfortable to work with, when exposure to computers is face-to-face, non-threatening, functional, and on-going. (Ehley, 1992).

Individualizing Instruction

Another aspect of effective computer instruction is individualizing training for teachers. In addition to making the teachers feel comfortable in the training sessions, trainers should also be sensitive to teacher's differing needs, abilities, and comfort levels (Jordan, 1993). Since teachers' time is very limited, they want to be instructed only in areas which are valuable and of interest to them. Therefore, training should be designed to meet teachers' individual needs.

One difficulty noted in Stecher and Solorzano's (1987) study was that the groups were far too heterogeneous in terms of individual beginning skill levels and the speed in which teachers were able to acquire new skills. Teachers felt that if they had prior computer experience, the training was sometimes "boring" or if they had not had prior computer experience, the training was "overwhelming" at times (Stecher & Solorzano, 1987). This heterogeneous environment made for a much more challenging class for the trainer and a much less useful one for the teachers. Another difficulty for individualizing the training sessions was the group size. In some classes, the ratio of students to trainer was thirty to one. An effort was made to provide teaching assistants to lower the ratios, but this was not always possible. Despite the difficult teaching situation, however, teachers in Stecher and Solorzano's (1987) study liked the fact that trainers were very responsive and patient with their individual questions.

One solution to these problems involved with individualization is to attempt to make groups smaller and as homogeneous as possible, thereby making the training accommodating to the needs of teachers on differing levels of development (Stecher & Solorzano, 1987). By making groups more homogeneous in composition, individual needs can be met in the most efficient manner possible. Since teachers already have such a limited amount of time to fulfill their basic obligations to students, parents, and the administration, computer training sessions must be a good investment of their time.

It was also recommended that the training occur on the school grounds to better adapt to teacher schedules and so that computer equipment that the school actually owns can be used (Jordan, 1993).

Incorporating Practicality and Hands-on Experience

It is essential that training sessions be practical in meeting the specific needs of teachers. Teachers want to know how the training will help them both personally and professionally (Stecher & Solorzano, 1987). Piotrowski (1992) found that teachers want to know how to integrate computers into the existing curriculum so that they can use them with their students. Hence, training should be very useful in nature, offering suggestions that are pertinent to the teacher's subject area and grade level (Stecher & Solorzano, 1987). It is helpful for each training session to offer at least one idea that can be used immediately in the classroom and introduce software applications within an instructional context (Jordan, 1993).

For this reason, it has been recommended that training be conducted by fellow teachers who are experts in the field, rather than outsiders who are unfamiliar with classroom applications. Recall that Becker (1992) suggested that being a part of a peer network of computer users was an essential element in acquiring computer literacy and applying it to the classroom curriculum. By having teachers train fellow teachers, a network is automatically established. Stecher and Solorzano experienced a great deal of success in their 1987 study by using teachers to train teachers.

Teachers showed a high degree of satisfaction with the skill level of the trainers who taught the classes because the participants felt that the trainers could relate the material well to applications in the classroom. Detailed lesson plans with clear objectives that related to classroom needs were written. Additionally, teachers felt that tips provided on how to use the technology in instruction with their students made the sessions more valuable (Stecher & Solorzano, 1987).

Another component of training sessions that makes them valuable is hands-on experience with the computer (Barker, 1994). This is especially beneficial when training sessions are conducted in the individual teacher's home school or classroom. Sessions that are not largely comprised of talk, and thus allow for plenty of guided practice, are the most effective. The existence of written materials to go along with training sessions has also been noted as a helpful measure, since they free the trainee from extensive note taking during the sessions and allow him or her more time for exploration (Stecher & Solorzano, 1987).

Training in Stages

Stages for Learning:

Probably the most critical issue which must be considered when planning training sessions is that teachers acquire computer literacy in stages (Ehley, 1992). As mentioned previously, training sessions must be planned to meet the needs of teachers who are on

different levels of achievement. Ehley proposed a model for the stages of literacy acquisition as shown in Figure 1.

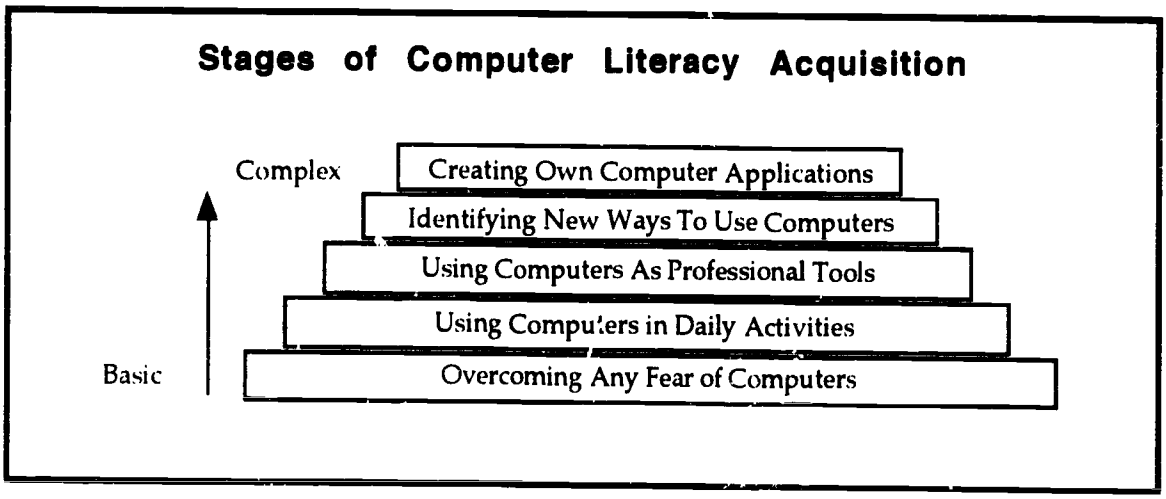


Figure 1

Notice that the stages progress from basic skills to more complex skills. Because it would be very difficult to have teachers on both the highest and lowest stages in one class, homogeneous grouping is ideal.

In order to help place teachers in homogeneous groups, Ehley (1992) suggests that a skills assessment be done to determine the beginning level of a particular teacher. This method provides the trainer with a reasonable starting point. By assessing teachers' needs, they would have some say in planning their in-service sessions. Each teacher should then be assisted in moving to a higher level of learning throughout the training (Ehley, 1992).

Stages for Training:

Literacy acquisition occurs in stages; therefore, it makes sense that training should also occur in stages. Ehley (1992) proposes a model shown in Figure 2 to represent the stages in which computer training should occur in order to follow the hierarchy of skill acquisition. As in the literacy acquisition model, training should progress from basic to more complex skills.

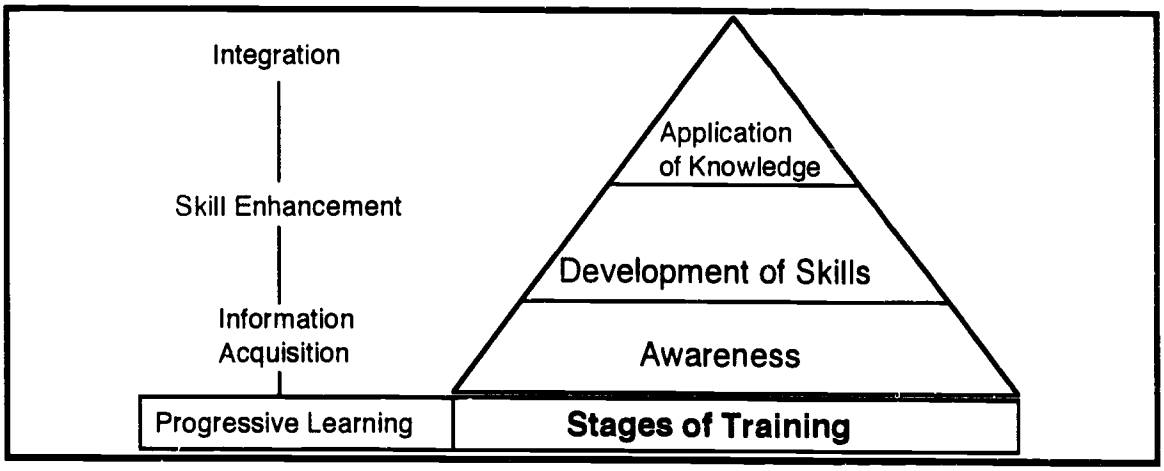


Figure 2

In the "Awareness" stage, the focus is on basic knowledge about computers. In the second stage ("Development of Skills"), the focus is on the basic operation of the equipment and on the use of applications. Finally, in the last stage ("Application of Knowledge"), the focus turns to the integration of computers into the content areas and using applications for management purposes (e.g. keeping attendance and grades) (Ehley, 1992; Jordan, 1993).

Multiple Sessions:

Considering that training should occur in stages, it is logical that teachers have noted the relative ineffectiveness of many past, short-term training sessions. They feel that it is unreasonable for teachers to become masters at using their computers when they only attend workshops for a few days out of the year (Piotrowski, 1992). It has been shown that a single, comprehensive in-service session for all teachers has failed to meet the complex training needs of individual teachers (Jordan, 1993). Teachers felt that they needed more practice time to truly process what they had learned (Stecher & Solorzano, 1987). This makes sense considering that teachers go through so many different stages when acquiring computer skills. It would be unreasonable to think that teachers go through all of these stages in a short period of time. Teachers in Stecher and Solorzano's (1987) study reported that they would have gained more from the sessions had they been able to learn less material in a day and then go back to their classrooms to practice it. After practicing the skills, they would have preferred to return to a training session and address problems before moving on to the next step of instruction (Stecher & Solorzano, 1987).

Finally, it is crucial that teachers are provided with some type of follow-up support after the training sessions (Jordan, 1993). In Stecher and Solorzano's (1987) study, structured follow-up support was not offered; thus, implementation of many of the new skills learned in the sessions was inhibited. The only occurrence of

follow-up support occurred informally in schools where there was a large population of computer-using teachers (Stecher & Solorzano, 1987).

Others have also asserted that training should definitely be long-term, although long term training sessions can be difficult to plan (Barker, 1994). In Stecher and Solorzano's (1987) study, sessions were generally either planned on in-service days, or teachers were provided release time from the classroom by way of substitutes. However, scheduling substitutes or being restricted by the length of time between in-service days presents obstacles for planning effective training. The researchers pointed out that both ongoing monetary and moral support from the administration was a minimum requirement for training sessions to be successful (Stecher & Solorzano, 1987).

Once the difficulties of planning and implementing computer training sessions have been overcome; however, the results showing the effect of the sessions have been very positive. Following her model of instruction, Ehley was able to report that overall computer use increased, computer anxiety decreased, and an integration of computers into traditional subject areas increased. Teachers in Stecher and Solorzano's (1987) study reported that they felt they benefited from the training sessions by increasing their skill level. Computer administrators reported that since the training sessions, there had even been a demand for more sessions (Stecher & Solorzano, 1987).

SUMMARY OF LITERATURE REVIEW

Because the use of computers has dramatically increased in society and particularly in schools, teachers and students alike must be prepared to use computers effectively. In order for teachers to educate students in effective computer use, however, teachers themselves must be educated in this subject. Effective computer education cannot occur, however, unless the administration and faculty remain supportive and willing to provide funding for training. However, effective training sessions must be planned in order for the investment in technology to be worthwhile to the schools. Effective training sessions must provide opportunities for decreased teacher anxiety; individualized instruction; hands-on, practical experience; and training in logical stages. Only training sessions that include these elements will be successful in producing exemplary computer using teachers.

Effective Training Sessions Should ...

- Work to decrease computer anxiety in teachers
- Invite voluntary participation only
- Offer a needs assessment in order to aid in the planning of the sessions
- Consist of small, homogeneous groups
- Address the specific needs of teachers
- Be as individualized as possible to accommodate differing needs, abilities, comfort levels, grade levels, and subject areas taught
- Offer multiple sessions which allow for practice of new material in between sessions
- Offer follow-up support
- Occur on school grounds
- Be conducted by fellow teachers
- Aid teachers in becoming part of a social network of computer using teachers
- Help teachers integrate technology into the existing curriculum
- Offer ideas that can be applied immediately to the classroom
- Demonstrate software applications within an instructional context
- Offer plenty of hands-on exploration

Hypothesis:

A model of computer training that is highly individualized, provides for hands-on learning, and occurs in stages will be effective in improving the skill levels and comfort levels of classroom teachers.

METHODS

RESEARCH PLAN

In our quest to find a meaningful and efficient way of educating teachers in using computers, we devised a research plan to implement and test the effectiveness of a particular model of computer training. Our model of training was based on the findings from the literature that showed that computer instruction should occur in a series of stages. Similar to Ehley's (1992) model, we proposed a framework with three major stages of computer training: overcoming fears and learning basic skills; applying skills in using applications/programs; and integrating computer knowledge into the classroom curriculum. Within this framework of stages, we employed a hands-on, individualized format, working one-on-one at the computer with the teacher we were training. The training occurred over several sessions, with sufficient time in between

sessions for the teacher to review, practice, and refine his or her skills.

Both before and after the training, quantitative and qualitative data were gathered about each teacher's skills and attitudes in connection with computers. Qualitative feedback evaluating the model of computer training was also obtained. Through our research we tested our hypothesis that successful computer instruction for classroom teachers follows a model of individualized training. By examining the written and experiential data, we assessed the effectiveness and usefulness of this model of computer training, subsequently providing recommendations for future training and research.

SAMPLE

The population we studied consisted of elementary school teachers. The sample for this study included six regular classroom teachers in a semi-rural elementary school (K-5) in central Virginia. The subjects were all female teachers with several years of teaching experience. As with most elementary school teachers, all of the teachers in the sample had busy schedules with virtually no unstructured time during the day. They were given a half-hour for lunch and a half-hour for planning during pull-out classes, such as P.E. and music. At the beginning of the school year, each classroom received a new Macintosh computer, and all of the computers in the school were connected through a network.

Our sample selection process began with the computer coordinator for the school identifying one classroom teacher from each of the six grade levels who possessed only a basic level of computer knowledge and experience and thus, was likely to benefit from our training project. Once identified, the teachers were under no obligation to participate. In accordance with other research we examined, we felt a voluntary participation approach would provide for the most effective training situation.

Therefore, we remained flexible when we discovered that not all identified teachers wanted to participate in the training program. While we had initially hoped to have a representative from each grade level in the training, we were unable to gain any third grade volunteers and decided to include another kindergarten teacher in place of a third grade teacher. As well, we were forced to replace the identified second grade teacher who was unwilling to participate with another second grade teacher who was more experienced with computers. The sample thus came to contain two teachers from kindergarten, one from first grade, one from second grade, one from fourth grade, and one from fifth grade. For these teachers, computer experience and use of the computer in the classroom ranged from minimal to moderate.

MEASUREMENT

Variables

In this study, the independent variable was our method of training, which was measured by comparing the results of a pre-assessment given before the training to a post-assessment given after the training. The key components of this method are the proposed stages of training and the individualized lesson format. The dependent variables measured were skill level, which was defined by the number of selected tasks the teachers were able to perform, and the comfort level the teachers had for performing the selected tasks. The hypothesis was tested by measuring the effect the computer training had on skill level and comfort level of the teachers.

Pre-assessment

To determine the needs and wants of teachers concerning skill level and comfort level, we created a pre-assessment (see Appendix A) which was administered to each teacher during the planning stages of our project. The teachers were given a week to complete the "Pre-Assessment". This assessment provided us with data to use in measuring any effect the training had on skill level and comfort level for each teacher. The results from these pre-assessments also helped us to place the teachers in the appropriate stage of training and individualize the training through specialized lesson plans.

Quantitative:

We divided the first half of the pre-assessment into six quantitative sections: Beginning; Desktop; General Computer Controls; Networks; Word Processing; and KidPix. The number of questions in each section ranged from four to twenty. The total number of questions was sixty-six. Each question was phrased in the form of a skill. Teachers were asked to circle "yes" if they could perform the skill or "no" if they did not know how to perform the skill. For each skill they were able to perform, they circled circle their comfort level in performing that skill: **1** = "not comfortable"; **2** = "moderately comfortable"; **3** = "very comfortable".

Qualitative:

The second half, entitled "Your Attitudes and Feedback," contained six open-ended, qualitative questions which attempted to identify more specific attitudes, skills, and needs (Table 1).

TABLE 1:

VII. Your Attitudes and Feedback

1. How do you feel in general about using the computer?
2. How often do you use your computer? For what purpose(s)?
3. Which applications do you use most and what is your comfort level in using them?
4. Which applications do you feel uncomfortable using or which ones would you like to learn more about?
5. Are there any particular skills that you would like to learn or refine?
6. Anything additional that you would like us to know in regard to your attitudes, experience, etc.

These qualitative data provided us with insight into the individual needs of each teacher. We were better able to understand our trainees and interpret their needs by discovering any other attitudes which were not represented in the quantitative section. We were also better able to make our training individualized and relevant by discovering any additional computer skills or applications each individual teacher had a desire to learn.

Post-assessment

Quantitative:

The "Post-Assessment" (see Appendix B) was based on the pre-assessment which was administered following the training. We wanted to make the quantitative post-assessment identical to the pre-assessment so that we could compare the data from the two to aid in testing the effectiveness of our training. We therefore used the same quantitative questions to assess the teachers' skill levels and comfort levels.

A few teachers went further in their learning than we had originally anticipated. For these teachers, some of the skills and applications which we taught them had not been included on the pre-assessment. In other words, there were no questions in the quantitative section of the pre-assessment which pertained to these skills. Keeping in mind that we were using the quantitative section of the assessments both to guide us in individualizing our lessons, and to allow us to perform a quantitative data analysis, we felt it would be ineffective to add the new skills to the quantitative

section of our post-assessment. Since we had no pre-training, quantitative data for these skills, we needed to gain the teachers' feedback on these skills in other ways.

Qualitative:

Because we had no quantitative data for some skill areas, we included some additional open-ended questions pertaining to these skills at the end of the post-assessment (Table 2). Another minor change we made from the pre-assessment to the post-assessment was to slightly alter the wording of two of the open, attitudinal questions so that they made sense in light of the training having been completed. Table 2 shows the first six questions in the qualitative section of the post-assessment, with only slight alterations to questions number one and five from the pre-assessment. These questions aided us in our qualitative data analysis.

TABLE 2:

VII. Your Attitudes and Feedback

1. How do you feel in general about using the computer since the training?
2. How often do you use your computer? For what purpose(s)?
3. Which applications do you use most and what is your comfort level in using them?
4. Which applications do you feel uncomfortable using or which ones would you like to learn more about?
5. Are there additional skills that you would like to learn or refine?
6. Anything additional that you would like us to know in regard to your attitudes, experience, etc.
7. Please state any additional skills you have learned that are not mentioned in this assessment.
8. Has your comfort level in using the computer increased since the training began? How?
9. Have your general computer skills increased since the training began? How?
10. Has the training better enabled you to use the computer in your classroom? How?
11. Do you think you will use the computer more in your classroom? In what ways?

Evaluation of Training

Attached to the end of the post-assessment was a section of open-ended questions entitled "Evaluation of Training" (Table 3), which pertained directly to the training program itself. We anticipated that the teacher responses to these questions would enable us to identify strengths and weaknesses of this method of training. From these data, we hoped to derive further conclusions concerning the effectiveness of our computer training method, additional implications of the training, and more ideas for future training programs and/or research.

TABLE 3:
Evaluation of Training

- In what ways did this training benefit you?
- What were the advantages and disadvantages of this type of training?
- What suggestions would you make to improve this method of training?
- Did you feel that your individual needs were met by this type of training?
- Would another method of training have been more beneficial to you? If so, explain.

Additional Feedback

In combination with the teachers' written answers to the open-ended questions on the post-assessment and training evaluation, we used informal verbal feedback from teachers, a formal interview of each teacher following the training, and written and verbal comments from the computer coordinator to assist us in a qualitative data analysis.

DESIGN

Planning

During the planning stages of our project, we met individually with all six teachers. The purpose of this meeting was to explain the project in more depth, to answer any questions the teacher might have, to gain insight into her skills, experiences, and feelings in using computers, and to establish a rapport with her so that she would feel comfortable during the training. We asked the teachers questions about their learning styles, attitudes toward the computer, and use of the computer in the classroom. In addition, we

asked each teacher to complete the pre-assessment and return it within a week.

Content of Lesson Plans:

The data gathered from the interviews and the pre-assessments allowed us to assess the level at which each teacher should begin training and to create individualized lesson plans for these teachers. Because there were two of us who would be separately conducting the computer training, it was important to make sure we were consistent in the overall content and method of training. Thus, we constructed a lesson plan for each stage of training (See Appendix D) directly from the pre-assessment. We then individualized it for each teacher by including skills about which they were unsure and omitting ones with which they were highly comfortable. The intent was to make the training relevant and interesting; therefore, we did not spend time covering skills and procedures which they already knew how to do.

In addition to addressing skills the teachers did not have or with which they were not completely comfortable, we focused on making the learning relevant by considering the comments on what the teachers wanted to learn and how they currently used the computers in their classrooms. Thus, we were able to create lesson plans which were practical in meeting their needs and wants. For those teachers who advanced quickly or started at a level higher than anticipated, our pre-assessment did not cover enough material to fill the training time. We, therefore, drew even more heavily

from these teachers' experiences and desires to identify additional skills to teach.

Appearance of Lesson Plans:

In order to aid each teacher in practicing her newly acquired skills in-between training sessions, we provided her with a copy of her individualized lesson plans which outlined the information covered. With this lesson plan, we hoped teachers would be able to recall more easily what we had included in the training and the steps we had followed to perform a particular procedure. With this independent reviewing in mind, we created the lesson plans using a logical outline format for listing the topics and procedures to be covered.

We also felt that for effective training, it was essential to design plans which were interesting to look at, made the teachers feel important as learners, and provided a model of what they can use in creating classroom material. For these reasons, we titled each lesson plan with the teacher's name in bold, included personalized clipart, and made the overall visual presentation appealing.

Training

The training was divided among the two trainers such that we each had three teachers with whom we worked for the entire period of the training. The training for each teacher consisted of two sessions of two hours each and one follow-up session of about forty-five minutes. We were able to schedule three training periods

consecutively in one day. Thus, each trainer trained all three teachers on one day for the first session and then the next week trained all three teachers on one day for the second session for a total of four training days (see Appendix E). Release time was arranged by the school, providing substitutes for three of the four training days. For the fourth day, the trainer who was not training substituted while the other trainer ran her training sessions. For each period of training, the substitute rotated classrooms, taking over each class for the two hours that the teacher was pulled out for training.

Checklists:

One week after each training session, we used a "checklist assessment" to determine the skills each teacher had learned during the previous training session. We used the individualized lesson plans to create the checklists. The checklists were simply a list of the skills and procedures covered in the previous training session. We then went down the list with the teacher asking her if she could remember how to do each procedure. If she either described how to do it correctly or actually performed it correctly we put a check next to the task. If she could not remember or seemed to be having trouble, we made note of this and then proceeded to review and offer further assistance as to how to do the procedure.

This checklist assessment was used for two primary reasons. First, it encouraged the teachers to practice their newly learned skills in between the training sessions. This practice not only

enabled them to better retain the knowledge they had learned, but it also allowed them to realize questions they had about a certain procedure and bring these questions back to the trainers at the next session. A second reason we used the checklists was because it provided us as trainers with a guide to creating and modifying the lessons for the next training session. In keeping with our stage-framework model of training, we used the checklists as a measure to define when a teacher had mastered the tasks of one stage of computer training and was ready to move on to the next stage.

Session One:

On day one of the training, the trainer and the teacher went through as many items as possible on the lesson plan in a hands-on manner. Working on one computer, the trainer first showed the teacher how to perform a task, and then allowed the teacher to try the task on her own. Through this one-on-one instruction at the computer, the trainer was able to answer questions and troubleshoot as necessary. This method aided the teacher in successfully understanding and performing the procedure.

Throughout the session, the trainer showed the teacher relevant applications of what she was learning. For example, in training how to create folders and organize documents, the trainer had the teacher make some folders for lesson units and some folders for administrative details in the classroom. By providing real examples for the teacher, the teacher has a better chance of understanding the process and remembering how to do the functions.

As well, the trainer made the learning interesting and fun, showing the teacher options to personalize her computer so that she would feel ownership and enjoy her work with it. At the end of the session, the trainer gave the teacher a copy of the day's lesson plan and suggested that she practice what she had learned. The teachers were told that any questions that they discovered while practicing would be addressed in the next training session.

Session Two:

Before day two of the training, each trainer combined the items that she did not have time to cover in session one, with additional items from the pre-assessment to create the second session's lesson plan for each teacher. Originally, the plan had been to use session one to teach Stage I and session two to teach Stage II, however, it was quickly realized that this plan would not be followed exactly. Because each teacher worked at a different pace, her mastery of the first stage and readiness to advance to the next stage did not necessarily correspond with the time frame for each session. Therefore, for the most part, the sessions did not differentiate the stages and the training occurred in accordance with each individual teacher's pace.

On day two of the training, many of the teachers requested to work in their own classrooms because they felt more comfortable with their own computers. For example, some teachers wanted help organizing their documents into folders. Ideally, it would have been helpful for each teacher to have the opportunity to work on her own

computer from the beginning. However, because her computer is in the classroom, we originally felt that working at her own computer might be more harmful than beneficial due to potential distractions from students and other teachers. However, for the second session, we did grant the requests of some teachers to work on their own computers because their need to feel comfortable outweighed the disadvantages of the possible distractions.

The first item on the agenda for session two was to go over what was learned in session one. As mentioned before, we used checklists to identify those tasks from the previous session which needed to be reviewed. With each item on the checklist, the trainer asked the teacher either to describe verbally how to perform the task or to actually perform it on the computer. If the teacher showed mastery of that task, the trainer moved on. At any point when the teacher was unsure how to perform a certain task, the trainer reviewed the procedure with her, again allowing the teacher to execute it on the computer.

The primary purpose of this checklist assessment was to identify any areas about which the teacher was still unclear. In some instances, the teacher knew how to do the task on the day it was taught, but had since forgotten or adopted a method of performing the task which was incorrect or inefficient. As the other research asserts, follow-up reinforcement provides more effective learning. The checklist was also used by the trainer as an

aid in assessing her own training so that she could improve on any weaknesses for future training.

After completing the checklist and answering any additional questions, the training for session two began. Although it covered different topics, session two followed the same training format as session one. As with session one, a procedure was shown and then the teacher was given the opportunity to do it herself. At any time she was able to take notes or ask questions, for the instruction was trainee-centered and she dictated the pace.

Follow-up

The third day was not a training session, but merely a follow-up session. As with session two, the trainer administered the checklist assessment for the previous session. Tasks and skills which were taught in session two were reviewed if necessary and any questions which had arisen since session two were answered. During the third and final visit, in addition to the checklist assessment of session two, the trainer interviewed the teacher. She posed questions similar to the open-ended questions on the post-assessment and the "Evaluation of Training." Finally, each teacher was handed the post-assessment and given a week to complete it.

DATA ANALYSIS

Quantitative

To test our hypothesis that this model of computer training would positively affect the teachers' levels of skills and levels of

comfort, we employed several different techniques for interpreting the data. First, we used cross tabulations to examine the relationships between the variables: level of skills by training and level of comfort by training. We interpreted these relationships using the Pearson Chi-Square statistic for significance and Gamma for direction and strength. A relationship was determined significant at the .05 level, highly significant at the .01 level, and very highly significant at the .001 level. Gamma determined strength along the scale of <.25 is weak, .25 to .5 is moderate, and .5 is strong.

In addition, we used the pre-assessments and post-assessments to look at the percent of tasks the teachers reported they could perform. Then we assessed the average comfort level teachers reported they felt in performing these tasks. For each assessment, we examined the teachers' results for each section and overall, comparing both across teacher and across section. Then, we compared the results from the pre-assessment with the results from the post-assessment to aid in testing our hypothesis.

To determine the percent of tasks a teacher could perform, we totaled the "yes" responses in each section of her assessment and then computed the percent this represented of the total questions in the section. For the overall percent of tasks she was able to do, we totaled the "yes" responses for the entire assessment and then computed the percent this represented of the total questions on the

assessment. For any missing value, we did not count that question in the total for the section or for the entire assessment.

To determine the average level of comfort, we coded each possible answer. For "very comfortable," which was represented by a "3," we gave a value of 3.0; for "moderately comfortable," which was represented by a "2," we gave a value of 2.0; and for "not comfortable," which was represented by a "1," we gave a value of 1.0. If the individual could not perform the task, then there was no level of comfort. Any task to which a teacher answered "no" to being able to perform was given a value of 0.0 on the comfort level scale. In a couple of instances, the teacher circled two of the numbers together instead of just one. Rather than counting this as a missing value, we gave a value of 2.5 if both "2" and "3" were circled or 1.5 if both "1" and "2" were circled.

For each section, we took the average comfort level by totaling the points the individual received for each question and dividing by the number of questions in the section. The average comfort level for the entire assessment was determined by totaling the points for the entire assessment and dividing by the total number of questions. The highest possible value for each section or for the entire assessment was 3.0, while the lowest possible value was 0.0. For any missing value, we did not count that question in the total for the section or for the entire assessment.

Qualitative

Assessment Data:

Because this research dealt with attitudes and feelings to a great extent, we felt it was important to employ a qualitative approach in addition to the quantitative data analysis in order to examine in more depth the effect our training had on the teachers. In doing so, on the two assessments, we asked open-ended questions about computer attitudes, skills, comfort, and uses (refer back to Tables 1 and 2). We examined the answers to these questions thoroughly, looking at each answer independently and also comparing the answers from the pre-assessment with those from the post-assessment for each teacher. As well, through this qualitative approach, we were able to determine the effect the training had on tasks and skills which had not been included in the quantitative section of the pre-assessment but had been covered in the training.

Evaluation of Training Data:

As another way of evaluating the training and its effectiveness, we asked teachers directly about their opinions regarding this model of training in the previously mentioned "Evaluation of Training" (refer back to Table 3). We asked them about the strengths and weaknesses of the model of training as well as how they thought the training affected their computer learning.

Interview Data:

During the personal interview, teachers were asked open-ended questions about their attitudes, skill level, comfort level, and

opinions about the training. While we did not anticipate answers to be very different from the written comments on the post-assessment and evaluation of training, the interview did provide the teachers with another means of expressing themselves. As well, it provided us with a tangible source of somewhat spontaneous responses.

Computer Coordinator Feedback:

Throughout the training, we remained in close contact with the computer coordinator for the school, both verbally and through electronic mail. We used any of his comments or feedback to assist us in evaluating the effectiveness of the training. In addition to his own opinions, he relayed to us any feedback he received from other staff members. This qualitative data was also useful in analyzing our model of training.

RESULTS

QUANTITATIVE DATA

We tested our hypothesis that a model of computer training which is highly individualized, provides for hands-on learning, and occurs in stages will be effective in improving the computer skills and comfort levels of classroom teachers. We interpreted the strength, direction, and significance levels of the relationships between the variables as revealed in the cross tabulations. In running a cross tabulation for training and skills, the Pearson Chi-Square test revealed a significance of .00248. This represents a highly significant relationship between skills and training which is not due to chance and thus can be generalized to the rest of the population. Gamma with a value of 1.00 showed that the relationship between training and the level of skills was positive and very strong, meaning that skills do improve with the addition of this model of computer training. Our hypothesis that training will improve skills is supported by these results.

A cross tabulation between training and attitudes also supports our hypothesis. The Pearson Chi-Square test revealed a significance of .00248. Again, this represents a highly significant relationship. The relationship between training and the level of comfort, therefore, is not due to chance and can be generalized to the rest of the population. As with level of skills, Gamma has a value of 1.00, indicating that the relationship between training and

the level of comfort is positive and very strong. In accordance with our hypothesis, the level of comfort will increase with the addition of this model of computer training.

Skills

Pre-Assessment:

We quantitatively examined the extent to which the training would improve skills by looking at the pre-assessment and post-assessment for each teacher. From the pre-assessment, we tallied the percentage of tasks for each section and the entire assessment that the teacher identified she could perform (Table 4).

TABLE 4: % Tasks Able To Perform On Pre-Assessment

	PRE-ASSESSMENT SECTIONS:						
TEACHER	I	II	III	IV	V	VI	TOTAL
A	1.00	0.26	0.40	1.00	0.35	0.29	**0.39**
B	1.00	0.89	0.80	1.00	0.70	0.00	**0.65**
C	1.00	1.00	0.60	0.50	1.00	0.00	**0.73**
D	1.00	0.53	0.20	0.25	0.60	0.00	**0.42**
E	1.00	0.79	0.00	0.50	0.75	0.00	**0.55**
F	1.00	0.47	0.40	0.50	0.35	0.00	**0.36**

* total percentages determined from entire assessment

The total values ranged from 36% to 73%, with the lowest in any section at 0% and the highest at 100%. Furthermore, we noticed some trends in the sections. For example, Section VI, which was KidPix, had only one teacher who previously knew how to perform any of the tasks. However, there was also a great range of ability in various sections. As well, a section which portrayed one teacher's

strengths was another's weaknesses. For example, Teacher A reported she could perform 100% in Section IV (Networks) but only 35% in Section V (Word Processing), while Teacher C could only perform 50% in the Network section but 100% in the Word Processing section. The need for individualized lesson plans was unmistakably clear.

Post-Assessment:

In examining the post-assessment, again we tallied the percentage of tasks for each section and the entire assessment that each teacher reported she could perform (Table 5). Across sections and teachers, there was a definite high ability level for skills measured by this assessment.

TABLE 5: % Tasks Able To Perform On Post-Assessment

	POST-ASSESSMENT SECTIONS:						
TEACHER	I	II	III	IV	V	VI	TOTAL
A	1.00	1.00	1.00	1.00	1.00	1.00	**1.00**
B	1.00	1.00	1.00	1.00	1.00	1.00	**1.00**
C	1.00	1.00	1.00	1.00	1.00	1.00	**1.00**
D	1.00	0.95	1.00	0.50	0.95	0.93	**0.92**
E	1.00	1.00	1.00	0.75	1.00	1.00	**0.98**
F	1.00	1.00	1.00	1.00	1.00	1.00	**1.00**

* total percentages determined from entire assessment

Four of the six teachers reported that they could perform a perfect 100% of the tasks on the assessment. The two lowest values of 50% and 75%, which are far lower than the next value nearest to them, occurred in Section IV (Networks) which only contained four

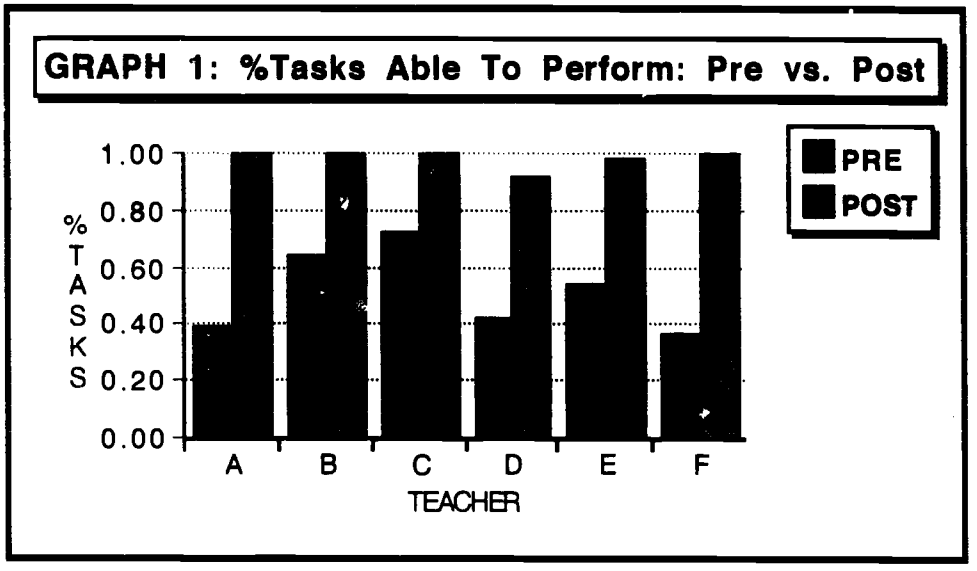
questions. So if a teacher scored 50%, it simply means that she could not perform two tasks, and if a teacher scored 75%, there was only one task she felt she could not perform. By looking at the total values, one can see the small effect these low percentages had on the overall percent of tasks able to perform. In this column, the lowest figure is a high 92%.

Comparison:

A comparison of the two sets of data reveals some encouraging results. Individually, teachers increased their skill level significantly. The two teachers who scored the lowest total values on the pre-assessment with 36% and 39% each soared to a perfect 100% on the post-assessment. As well, individual sections of the assessment showed marked improvement from pre to post. For example, in Section V (KidPix) on the pre-assessment, there were five teachers who reported they could do none of the tasks, while the sixth could only do 29%. On the post-assessment, however, five of the teachers reported they could perform 100% of the tasks and the sixth was not far behind with 93%. Another section which shows solid improvement across the board is Section III (General Computer Controls). On the pre-assessment, the values ranged from 0% to 80%, with the mean at 40%. On the post-assessment every teacher reported that they could perform 100% of the tasks in Section III.

TABLE 6: Total % Tasks Able to Perform			
	ASSESSMENT:		
TEACHER	PRE	POST	CHANGE
A	0.39	1.00	+ 0.61
B	0.65	1.00	+ 0.35
C	0.73	1.00	+ 0.27
D	0.42	0.92	+ 0.50
E	0.55	0.98	+ 0.43
F	0.36	1.00	+ 0.64
AVERAGE:	0.52	0.98	+ 0.47

As noted in Table 6, the Total percent of tasks which teachers were able to perform consistently changed positively and substantially from the pre to post-assessment. The average percentage of tasks the teachers could perform before the training was 52%, while after the training, they could perform an average of 98% of the tasks, yielding a +47% average change in the number of tasks able to be performed. The pictorial depiction of the difference in the percent of tasks which teachers could perform before the training as compared to after the training is even more convincing (Graph 1).



Comfort

Pre-Assessment:

In addition to skills, we were interested in knowing the comfort level each teacher possessed in performing a certain skill. Examining the pre-assessment and post-assessment allowed us to measure how the training affected comfort level. As noted in Table 7, for each section and for the entire pre-assessment, we calculated the average comfort level that the teacher felt when performing the tasks.

TABLE 7: Average Comfort Level on Pre-Assessment

	PRE-ASSESSMENT SECTIONS:						
TEACHER	I	II	III	IV	V	VI	TOTAL
A	3.0	0.8	1.0	2.4	0.9	0.7	**1.1**
B	3.0	2.7	2.0	2.0	1.9	0.0	**1.8**
C	3.0	3.0	1.8	1.5	3.0	0.0	**2.2**
D	3.0	1.1	0.6	0.8	1.5	0.0	**1.0**
E	3.0	2.2	0.0	1.5	2.1	0.0	**1.5**
F	2.8	1.2	0.8	1.3	0.8	0.0	**0.9**

* total percentages determined from entire assessment

The Total values ranged from 0.9, which translates to "not comfortable," to 2.2, which is only "moderately comfortable." Within the assessment, the lowest level of comfort for any section was 0.0 and the highest was 3.0, allowing for the full range.

As with the skills portion, there were trends along section lines. For example, Section VI (KidPix) consistently showed responses in a range from no comfort level to a level of "not comfortable." Five of the six teachers reported no comfort level for the KidPix section, meaning that they could not perform any of the tasks and therefore did not measure a comfort level. The sixth teacher remained just under the "not comfortable" mark. There was a variety in levels of comfort for individual teachers, too. For example, while Teacher C reported 3.0 for three sections, she also reported 0.0, or no comfort level, for one section and 1.5, which is barely considered "moderately comfortable," for another section. As well, a great variety of comfort levels between the teachers, as

with the skills data, stressed the definite need for individualized lesson plans.

Post-Assessment:

We measured comfort level in the post-assessment in the same manner as we had for the pre-assessment, computing the average for each section and then for the entire assessment (Table 8). Across sections and teachers, there was a consistently high comfort level, with only two teachers in one section falling below the "very comfortable" line. For two sections, Section I (Beginning) and Section III (General Controls), every teacher reported the highest score possible. The total average levels of comfort ranged from 2.7 to 3.0, all placed within the "very comfortable" range.

TABLE 8: Average Comfort Level on Post-Assessment

	POST-ASSESSMENT SECTIONS:						
TEACHER	I	II	III	IV	V	VI	TOTAL
A	3.0	2.9	3.0	2.8	2.9	3.0	**2.9**
B	3.0	3.0	3.0	3.0	3.0	3.0	**3.0**
C	3.0	3.0	3.0	3.0	3.0	3.0	**3.0**
D	3.0	2.7	3.0	1.5	2.8	2.8	**2.7**
E	3.0	3.0	3.0	2.3	2.9	2.9	**2.9**
F	3.0	2.8	3.0	3.0	3.0	3.0	**2.9**

* total percentages determined from entire assessment

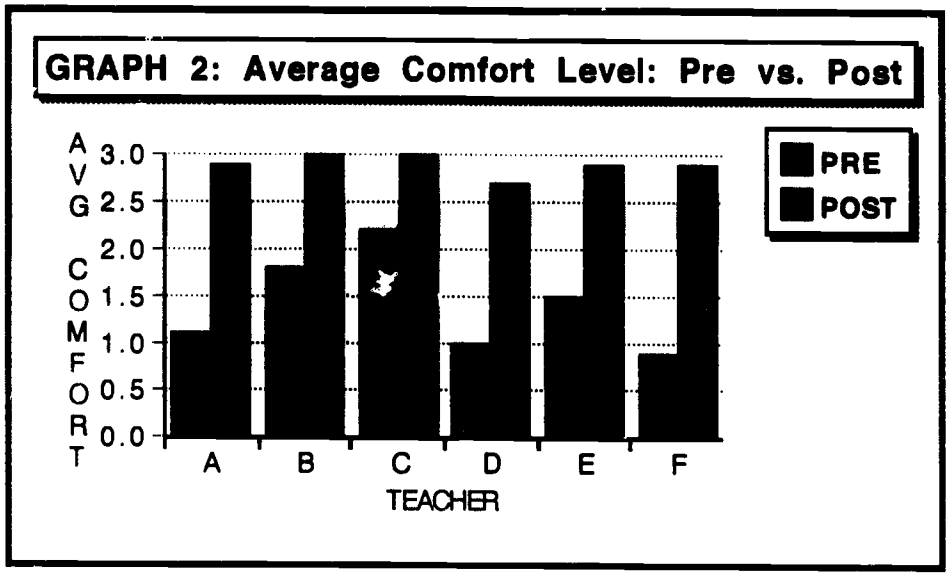
Comparison:

In comparing the data from the pre-assessment and post-assessment, we found that individually and across sections, comfort levels increased dramatically. Teacher F, who averaged a comfort level of only 0.9 or "not comfortable" for the entire pre-assessment, increased to an average comfort level of 2.9 or "very comfortable" for the post-assessment. As well, in Section VI (KidPix) of the post-assessment, the average scores ranged from 2.8 to 3.0 with four of the six teachers averaging a perfect 3.0. These averages increased significantly from the pre-assessment which had only one teacher reporting comfort levels above 0.0 for that section. It is important to keep in mind, though, that these other five teachers did not know how to perform any of the tasks in this section. It is therefore, logical to assume that once they had learned a task, they would be able to register a comfort level for the task. However, it is still a significant point that these comfort levels reported were all very high.

Section III (General Controls) also shows remarkable improvement in comfort levels. The pre-assessment range was 0.0 to 2.0, with a mean of 1.0, while the post-assessment revealed a 3.0 for every teacher. This is especially important because the general controls allow the teacher to personalize and feel power over her computer. We believe this is crucial to the enjoyment of using her computer.

TABLE 9: Average Comfort Level			
	ASSESSMENT:		
TEACHER	PRE	POST	CHANGE
A	1.1	2.9	+1.8
B	1.8	3.0	+1.2
C	2.2	3.0	+0.8
D	1.0	2.7	+1.7
E	1.5	2.9	+1.4
F	0.9	2.9	+2.0
AVERAGE:	1.4	2.9	+1.5

Table 9 shows the overall change from the pre-assessment to the post-assessment for each teacher and the average of all teachers. Notice, the change was positive for all teachers. The average comfort level for all the teachers reported on the pre-assessment was 1.4, which is interpreted as "not comfortable," while the average comfort level for all the teachers on the post-assessment improved to 2.9, "very comfortable," yielding a +1.5 point average change in comfort level. These positive changes in comfort level from the pre-assessment to the post-assessment are profoundly evident in the graph representation (Graph 2).



QUALITATIVE DATA

Skills

We obtained qualitative data about skill level for two reasons. The first reason was to use the data to assist us in meeting each teacher's needs and wants in an individualized training setting. The second was to use the data to examine the effect training had on skill level and to test our hypothesis in determining the effectiveness of our method of training. In examining the effect the training had on skill level, we found that the overall qualitative feedback concerning skills was very positive.

All teachers expressed that their skills had improved and their skill level had increased. As one teacher wrote, "I was able to fill in a lot of the blanks I had." In addition to stating an improvement in skills, many teachers acknowledged the positive consequences which were a result of knowing more about their computer and how

to use it. "I feel I know so much more. This has given me more options," explained one teacher. Subsequently, several teachers communicated a connection between knowing more skills and feeling more comfortable using the computer. They expressed that, because they had mastered important skills which they had been inept at before, they felt more comfortable in using the computer in their classroom, for example "[using] databases to make literary reports for book reviews."

In addition to being able to share valuable computer knowledge with their students, the teachers expressed an ability and desire to share their knowledge with other teachers. One teacher explained that she now demonstrated the skills she had learned to her Teaching Assistant who had previously been the computer expert in their classroom. Likewise, many teachers admitted to using their knowledge to assist colleagues on their grade level teams and even across grade levels.

Comfort

For all teachers, comfort level and skill level existed in a reciprocal relationship, each contributing to the improvement of the other. As mentioned above, many teachers in this study expressed the effect acquiring more skills had on improving their comfort in using the computer in their classrooms. In addition, there was a consensus that an increase in comfort level affected their skills because they felt at ease practicing, refining, and expanding these skills.

The effects that this model of training had on comfort level were apparent in the qualitative feedback where enthusiasm abounded. One teacher wrote that she felt "more knowledgeable, more self-assured, and definitely more comfortable" because of the training. Others saw it as a stepping stone to the realization that computers are not to be feared. For example, one teacher stated in her interview, "[The training] was a growing a experience for me. It let me know that ' can indeed do it, where before I was unsure."

Again, as with skills, teachers saw the importance and significance of their increased comfort level. For example, the quelling of their fears had a positive impact in that they were more likely to explore new realms of the computer. "I am not afraid to try something new," pointed out one teacher. As well, the teachers not only were comfortable in using the computer on their own, but were now confident in integrating the computer into their classroom curriculum. One teacher appropriately summed it up in these words, "The more comfortable I feel with [the computer], the more comfortable I feel transferring it to students."

Evaluation of Training

The overall feedback for our training was extremely favorable. The computer coordinator wrote to us on electronic mail, "Response to your training sessions has been OVERWHELMINGLY positive. Excellent work!" Teachers who participated found few weaknesses, claiming it was a great success. They said they had acquired many new skills, were more comfortable, and enjoyed learning through the

model of training we had employed. Encouraging comments from other individuals outside of the study were not lacking either. As the computer coordinator wrote to us on another occasion, some teachers were now upset with him because they had not been invited to participate. "Funny," he notes, "I had originally had trouble getting enough people."

Of those teachers who participated, the evaluative comments about the training involved several key aspects of the model of training. Teachers focused their feedback on these aspects of our model: individualization, hands-on learning, stages which allowed for practice time, number of sessions, time of day of sessions, and amount of time for a session.

Individualization:

"I see no disadvantage, only a definite advantage, having a one to one training session. I have had other computer classes and none were as beneficial," wrote one teacher on her evaluation of our method of training. Across the board, teachers saw individualized training only as a strength. They favored the one-on-one attention which they received in this training over the group in-service sessions to which they were accustomed. As one teacher wrote, "I am most appreciative of the opportunity to have one to one training --It was invaluable to me."

Many teachers saw the individualized training as a strength because it made them feel important as learners. The training followed each teacher's own learning pace. There was the

opportunity "for questions when needed... [and] time to stop and repeat/review/ explain." Also, they liked the fact that the training did not waste their time with any information which they already knew, for which they were not yet ready, or in which they were not interested. "[We] covered things that were important to me," explained one satisfied teacher.

Yet another factor in the individualized training was the lesson plans we created. One teacher confirmed that her individual needs were met through "individual lesson plans with detailed things to cover." Another teacher explained that she really appreciated having the lesson plans as she reviewed and practiced between sessions. She used it as a map to help her remember topics and steps to procedures.

Hands-On:

As is true for most individuals, one teacher wrote, "I learn best by doing." All of the teachers who participated acknowledged the benefit of learning directly on the computer. "I am a 'show me' 'involve me' learner. This was wonderful," explained one participant. Another teacher wrote, "I found out [that] spending time, trying out things on the computer [was the] best way to learn and expand my confidence level." In addition, those teachers who moved to their own computer for the second training session admitted that this was a great strength. "Conducting the training using my computer as opposed to [another computer] was most helpful."

Stages and Practice Time:

Every teacher appreciated the time between training sessions which they were given to absorb, review, and practice the information they had learned before moving on to new information. They felt that a week was a good amount of time to allow between sessions. As some teachers explained, any more time would have been ineffective because the follow-up support would have been delayed too much. Any less time would have been overwhelming.

Number of Sessions:

It was unanimous among the teachers that there were not enough training sessions, with which we, too, agreed. Our time constraints hindered the amount of training we could provide the teachers. Under ideal circumstances, we would have liked to have continued the training for a longer period of time. Comments we received from the teachers concerning amount of training all pointed to the need for more sessions. One teacher wrote, "A third session would have been great," while another wrote, "Not enough time, would love to have another session!" The computer coordinator even received a phone-call at home in which a teacher confessed, "I am bummed that I only get two training sessions."

Time of Day:

There were differing opinions regarding the time of day during which the training took place. Some teachers stated that they liked the convenience of having the training during the school day, because they did not have to arrange their own afternoon schedules to fit the

training and they were not exhausted as they often are after school. Yet, other teachers wished that the training had taken place after school. These teachers found it difficult and inconvenient to plan for a substitute for a two-hour block of time during the school day and did not like missing the teaching time.

Amount of Time for Session:

In general, most teachers were happy with the amount of time allowed for each session of training. They felt two hours was optimal. One teacher, however, expressed her opinion that two hours was too much for straight training. After an hour and a half, she explained, her "brain was saturated" with information. She suggested that she would have liked to have had the last half-hour to merely practice and explore what she had learned.

CONCLUSIONS AND DISCUSSION

A complete analysis of the data collected throughout this study strongly supports the hypothesis that a model of computer training which is highly individualized, provides for hands-on learning, and occurs in stages will be effective in improving the skill levels and comfort levels of classroom teachers. In addition, we found that this model of training helped to elevate teachers' self-confidence and enthusiasm in using the computer.

In examining the quantitative data collected, we found strong evidence that our proposed model of computer training is indeed an effective method of training teachers to use the computer. The greatly improved skill level suggested that teachers had become more equipped to use computers in their daily lives and integrate them into their classrooms. The greatly increased comfort level implied that this model of training not only improved teacher's skills but allowed teachers to feel more comfortable using these skills.

The qualitative data gathered further elaborated on the quantitative data, providing more in-depth information about skills and comfort level. All of the teachers felt that their skill and comfort levels had greatly improved since the training. Teachers repeatedly attributed much of this success to the method of training itself. Teachers particularly liked the one-on-one instruction with a sufficient amount of time in between sessions to practice.

Teachers also liked the fact that the training accommodated their individual needs by providing ample time for asking questions and re-teaching if necessary.

Based on the qualitative comments gathered in the study, it can also be concluded that teachers will most likely use their computers more for a variety of tasks. Teachers plan to share the knowledge they gained with other teachers in the school and also with students. By sharing their knowledge with others, a support network is established which not only helps improve skill level, but also helps to establish a positive, exciting environment for computer using teachers. This excitement will most likely be spread to other educators in the building who are not currently using computers. This diffusing of knowledge is important since the ultimate goal in educating teachers in computer technology is for the knowledge to be spread to other teachers and students.

Overall, we feel that this model of training proved to be highly effective and could be implemented in other schools with similar needs. Beyond discovering that this model of training is effective, however, we also discovered factors that are essential to the successful implementation of it. First of all, the training sessions were supported by the administration through funding for substitute teachers so that the training could take place on school grounds during regular school hours. Most teachers found this to be very accommodating to their schedules, but it is important to keep in

mind teacher preferences when planning sessions as some teachers would prefer to have training after school.

Secondly, multiple sessions in stages could be offered because of sufficient substitute coverage. Multiple sessions were essential because teachers had an opportunity to practice skills learned before moving on to new skills. Furthermore, the week between the sessions was ideal because teachers remained involved and interested.

Finally, the training sessions could be highly individualized only by basing instruction on a skills/needs assessment. Had the pre-assessment not been done, we would not have known what content to cover in the training. By individualizing the training, teachers were able to have plenty of hands-on computer experience in a non-threatening environment. Teachers were permitted to ask questions at any time during the training and were shown specific ways in which the technology they were learning could be incorporated into the curriculum.

As mentioned before, with the growing number of computers in the schools, having basic computer skills is definitely a necessity. Teachers will need these skills in order to perform daily tasks and to serve as an example for students. Students who learn computer skills in school will be better prepared to enter the work force.

Summary of Conclusions

- Opportunities for training must be supported by the school administration.
- A skills/needs assessment is essential.
- Individualized instruction is most effective; on-on-one is ideal.
- Hands-on experience using teachers' personal computers is preferable.
- Allowing time for questions is important.
- Time of training should respect teacher preferences.
- Multiple sessions in stages with time in between for practice are needed.
- Ongoing training is needed.

RECOMMENDATIONS FOR FUTURE RESEARCH AND TRAINING

The most important recommendation for doing future research and training is to allow more time for the development and implementation of the training. By allowing more time, more training sessions could be offered, thus allowing the teachers to progress through the stages at a more natural speed. Also, teachers would have more room to progress to higher levels, for example, actually implementing the technology into the classroom. Secondly, better follow-up support could be offered to teachers, thus continuing to improve their level of comfort and their level of usage of the computer. Finally, a larger sample of teachers and schools could be used thereby further validating and substantiating the findings.

Another recommendation would be to use more comprehensive, objective assessments. The assessments should stretch far beyond the current level of skills of the teachers so that teachers have room to expand and fully demonstrate their knowledge. In this particular study, the pre- and post- assessments by far did not show all of the tasks that the teachers had the opportunity to learn. The assessments should also consist of more objective qualitative questions so that the results are more convincing. Some of the questions, particularly in the "Evaluation of Training" were somewhat leading. In addition, it is important to note that the

checklist assessments were self-evaluations. The results in many instances were based on teachers telling us that they were able to perform the tasks. The problem with this is that the teacher might feel that she is able to do the task, but is really not able to remember the procedure. If more time had been available, it would have been possible to ask the teacher to perform every task as a method of assessment.

Lastly, it is recommended that all available resources be used to facilitate the training. Schools should look to expert teachers in their buildings who can provide training. As mentioned before, teachers like the idea of being trained by fellow teachers with whom they are comfortable. If teachers in the building are not a possibility, a school might turn to a local college or university as done in this study. Finally, community resources such as businesses and parents can be used to provide training or to provide release time for teachers.

Computer training is becoming more of a demand every day as schools gain more technology. Effective training is possible even if budgets are tight. Schools who succeed in this highly computerized world will be those who find creative, effective means for providing continuing technology education for their teachers.

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APPENDIX

Grade level_____

Pre-Assessment

(1) Please indicate whether you are currently able to perform the following tasks or procedures by circling **"yes"** or **"no."**

(2) For those tasks or procedures which you are able to perform, please circle the most appropriate response as to how you feel about performing them.

1 = not comfortable
2 = moderately comfortable
3 = very comfortable

I. Beginning

1. **Turning on the computer**
   Yes No 1 2 3

2. **Moving the mouse**
   Yes No 1 2 3

3. **Clicking and double-clicking when appropriate**
   Yes No 1 2 3

4. **Using the mouse to drag**
   Yes No 1 2 3

II. Desktop

1. **Opening the hard drive**
   Yes No 1 2 3

2. **Opening an application (for example, ClarisWorks)**
   Yes No 1 2 3

3. **Opening a saved document on the hard drive**
   Yes No 1 2 3

4. **Opening a saved document from a disk**
   Yes No 1 2 3

5. **Copying a document from the disk to the hard drive and vice versa**
   Yes No 1 2 3

6. **Copying multiple files at the same time**
   Yes No 1 2 3

7. **Deleting a document from the hard drive or a disk**
   Yes No 1 2 3

8. **Opening the trash can**
   Yes No 1 2 3

9. **Creating a new folder**
   Yes No 1 2 3

10. **Closing windows on the desktop**
    Yes No 1 2 3

11. **Switching from one open window to another open window**
    Yes No 1 2 3

12. **Arranging the view of a window by name, icon, or date**
    Yes No 1 2 3

13. **Identifying a folder, document, or application icon**
    Yes No 1 2 3

14. **Using the finder to locate/select applications and files**
    Yes No 1 2 3

15. **Closing a document**
    Yes No 1 2 3

16. Quitting an application
Yes No 1 2 3

17. Formatting a disk
Yes No 1 2 3

18. Ejecting a disk from the computer
Yes No 1 2 3

19. Safely shutting down or restarting the computer
Yes No 1 2 3

III. General Computer Controls

1. Increasing or decreasing the volume of the sound
Yes No 1 2 3

2. Changing the color (label) of folders and documents
Yes No 1 2 3

3. Changing the pattern of the desktop background
Yes No 1 2 3

4. Using the calculator
Yes No 1 2 3

5. Changing the destination of a document to be printed (Which printer?)
Yes No 1 2 3

IV. Networks

1. Logging on to the network
Yes No 1 2 3

2. Accessing programs on the network server
Yes No 1 2 3

3. Changing your network password
Yes No 1 2 3

4. **Copying files to and from the network server**
   Yes No 1 2 3

V. **Word Processing**

1. **Creating a new document**
   Yes No 1 2 3

2. **Using the mouse to position the cursor**
   Yes No 1 2 3

3. **Adjusting the margins of a document**
   Yes No 1 2 3

4. **Creating tabs**
   Yes No 1 2 3

5. **Knowing when to use tabs and when to use spaces**
   Yes No 1 2 3

6. **Positioning text in a document (i.e. centering, right justifying, etc.)**
   Yes No 1 2 3

7. **Selecting (highlighting) a word or words for the purpose of editing**
   Yes No 1 2 3

8. **Selecting (highlighting) the entire document**
   Yes No 1 2 3

9. **Changing the font**
   Yes No 1 2 3

10. **Changing the style of a font**
    Yes No 1 2 3

11. **Changing the size of a font**
    Yes No 1 2 3

12. **Cutting, copying, and pasting text within an application**
    Yes No 1 2 3

13. **Cutting, copying, and pasting text from one application to another**
    Yes No 1 2 3

14. **Undoing the last procedure**
    Yes No 1 2 3

15. **Checking the spelling**
    Yes No 1 2 3

16. **Saving a new document**
    Yes No 1 2 3

17. **Saving an existing document under a different name**
    Yes No 1 2 3

18. **Choosing the destination of a saved document (i.e. hard drive, disk, etc.)**
    Yes No 1 2 3

19. **Printing a document**
    Yes No 1 2 3

20. **Changing print options (i.e. quality, number of copies, etc.)**
    Yes No 1 2 3

VI. KidPix

1. **Drawing with the pencil**
   Yes No 1 2 3

2. **Using stamps**
   Yes No 1 2 3

3. **Erasing**
   Yes No 1 2 3

4. **Changing eraser options**
   Yes No 1 2 3

5. **Changing the color**
   Yes No 1 2 3

6. **Using the "straight line" tool**
   Yes No 1 2 3

7. **Using the "square" and "circle" drawing tools**
   Yes No 1 2 3

8. **Using the paint bucket to fill in color**
   Yes No 1 2 3

9. **Changing paintbrush options**
   Yes No 1 2 3

10. **Undoing the last procedure**
    Yes No 1 2 3

11. **Moving an object to another location**
    Yes No 1 2 3

12. **Cutting and pasting**
    Yes No 1 2 3

13. **Saving a document**
    Yes No 1 2 3

14. **Printing a document**
    Yes No 1 2 3

VII. Your Attitudes and Feedback

Please be thorough in your answers and provide examples whenever possible.

1. How do you feel in general about using the computer?

2. How often do you use your computer? For what purpose(s)?

3. Which applications do you use most and what is your comfort level in using them?

4. Which applications do you feel uncomfortable using or which ones would you like to learn more about?

5. Are there any particular skills that you would like to learn or refine?

6. Anything additional that you would like us to know in regard to your attitudes, experience, etc.

Grade level_____

Post-Assessment

(1) Please indicate whether you are currently able to perform the following tasks or procedures by circling **"yes"** or **"no."**

(2) For those tasks or procedures which you are able to perform, please circle the most appropriate response as to how you feel about performing them.

1 = not comfortable
2 = moderately comfortable
3 = very comfortable

I. Beginning

1. **Turning on the computer**
   Yes No 1 2 3

2. **Moving the mouse**
   Yes No 1 2 3

3. **Clicking and double-clicking when appropriate**
   Yes No 1 2 3

4. **Using the mouse to drag**
   Yes No 1 2 3

II. Desktop

1. **Opening the hard drive**
   Yes No 1 2 3

2. **Opening an application (for example, ClarisWorks)**
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3. **Opening a saved document on the hard drive**
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5. **Copying a document from the disk to the hard drive and vice versa**
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6. **Copying multiple files at the same time**
   Yes No 1 2 3

7. **Deleting a document from the hard drive or a disk**
   Yes No 1 2 3

8. **Opening the trash can**
   Yes No 1 2 3

9. **Creating a new folder**
   Yes No 1 2 3

10. **Closing windows on the desktop**
    Yes No 1 2 3

11. **Switching from one open window to another open window**
    Yes No 1 2 3

12. **Arranging the view of a window by name, icon, or date**
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13. **Identifying a folder, document, or application icon**
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14. **Using the finder to locate/select applications and files**
    Yes No 1 2 3

15. **Closing a document**
    Yes No 1 2 3

16. Quitting an application
Yes No 1 2 3

17. Formatting a disk
Yes No 1 2 3

18. Ejecting a disk from the computer
Yes No 1 2 3

19. Safely shutting down or restarting the computer
Yes No 1 2 3

III. General Computer Controls

1. Increasing or decreasing the volume of the sound
Yes No 1 2 3

2. Changing the color (label) of folders and documents
Yes No 1 2 3

3. Changing the pattern of the desktop background
Yes No 1 2 3

4. Using the calculator
Yes No 1 2 3

5. Changing the destination of a document to be printed (Which printer?)
Yes No 1 2 3

IV. Networks

1. Logging on to the network
Yes No 1 2 3

2. Accessing programs on the network server
Yes No 1 2 3

3. Changing your network password
Yes No 1 2 3

4. **Copying files to and from the network server**
   Yes No 1 2 3

V. **Word Processing**

1. **Creating a new document**
   Yes No 1 2 3

2. **Using the mouse to position the cursor**
   Yes No 1 2 3

3. **Adjusting the margins of a document**
   Yes No 1 2 3

4. **Creating tabs**
   Yes No 1 2 3

5. **Knowing when to use tabs and when to use spaces**
   Yes No 1 2 3

6. **Positioning text in a document (i.e. centering, right justifying, etc.)**
   Yes No 1 2 3

7. **Selecting (highlighting) a word or words for the purpose of editing**
   Yes No 1 2 3

8. **Selecting (highlighting) the entire document**
   Yes No 1 2 3

9. **Changing the font**
   Yes No 1 2 3

10. **Changing the style of a font**
    Yes No 1 2 3

11. **Changing the size of a font**
    Yes No 1 2 3

12. **Cutting, copying, and pasting text within an application**
    Yes No 1 2 3

13. **Cutting, copying, and pasting text from one application to another**
    Yes No 1 2 3

14. **Undoing the last procedure**
    Yes No 1 2 3

15. **Checking the spelling**
    Yes No 1 2 3

16. **Saving a new document**
    Yes No 1 2 3

17. **Saving an existing document under a different name**
    Yes No 1 2 3

18. **Choosing the destination of a saved document (i.e. hard drive, disk, etc.)**
    Yes No 1 2 3

19. **Printing a document**
    Yes No 1 2 3

20. **Changing print options (i.e. quality, number of copies, etc.)**
    Yes No 1 2 3

VI. KidPix

1. **Drawing with the pencil**
   Yes No 1 2 3

2. **Using stamps**
   Yes No 1 2 3

3. **Erasing**
   Yes No 1 2 3

4. **Changing eraser options**
   Yes No 1 2 3

5. **Changing the color**
   Yes No 1 2 3

6. **Using the "straight line" tool**
   Yes No 1 2 3

7. **Using the "square" and "circle" drawing tools**
   Yes No 1 2 3

8. **Using the paint bucket to fill in color**
   Yes No 1 2 3

9. **Changing paintbrush options**
   Yes No 1 2 3

10. **Undoing the last procedure**
    Yes No 1 2 3

11. **Moving an object to another location**
    Yes No 1 2 3

12. **Cutting and pasting**
    Yes No 1 2 3

13. **Saving a document**
    Yes No 1 2 3

14. **Printing a document**
    Yes No 1 2 3

VII. Your Attitudes and Feedback

Please be thorough in your answers and provide examples whenever possible.

1. How do you feel in general about using the computer since the training?

2. How often do you use your computer? For what purpose(s)?

3. Which applications do you use most and what is your comfort level in using them?

4. Which applications do you feel uncomfortable using or which ones would you like to learn more about?

5. Are there additional skills that you would like to learn or refine?

6. Anything additional that you would like us to know in regard to your attitudes, experience, etc.

7. Please state any additional skills you have learned that are not mentioned in this assessment.

8. Has your comfort level in using the computer increased since the training began? How?

9. Have your general computer skills increased since the training began? How?

10. Has the training better enabled you to use the computer in your classroom? How?

11. Do you think you will use the computer more in your classroom? In what ways?

Evaluation of Training

- In what ways did this training benefit you?

- What were the advantages and disadvantages of this type of training?

- What suggestions would you make to improve this method of training?

- Did you feel that your individual needs were met by this type of training? Why or why not?

- Would another method of training have been more beneficial to you? If so, explain.

Sample Lesson Plan*

I. Desktop Issues
___ • Changing background
___ • Changing sound
___ • Using calculator
___ • Opening hard drive to identify icons
___ • What open apple items mean

II. Organizing/Working With Disks
___ • Formatting a blank disk
___ • Opening a disk
___ • Creating folders
___ • Copying multiple files into folders (2 ways)
___ • Creating folders within folders
___ • Labeling (coloring) folders
___ • Opening a folder to change the view
___ • Copying a folder to hard drive
___ • Trashing an item
___ • Checking trash can before emptying
___ • Emptying trash
___ • Copy ClarisWorks for the classroom disk
___ • Explore disk if desired (show book)
___ • Ejecting disk

III. Network Items
___ • Finding Clip Art
___ • Exploring other network programs

IV. Word Processing Refinement
___ • Finding on-line help
___ • Changing margins
___ • Creating tabs (2 ways)
___ • Using Clip Art
___ • Cutting
___ • Copying
___ • Pasting
___ • Clipboard

___ • Show finder options
___ • Undoing
___ • Spelling check
___ • Advantages to save as (templates)
___ • Saving to a specific location
___ • Making stationery
___ • Saving stationery
___ • Using stationery
___ • Changing print options (# of copies, etc.)

V. KidPix

___ • Shift, command, option with all of the following:
___ • Pencil
___ • Straight line
___ • Square/Circle
___ • Paintbrush
___ • Mixer
___ • Paint bucket
___ • Eraser
___ • Typing
___ • Stamps
___ • Cutting/pasting
___ • Moving
___ • Undo
___ • Small Kids Mode
___ • Recording sound
___ • Changing stamps
___ • Changing to Spanish
___ • Draw Me

*This sample does not include the clipart which was included in the real lesson plans.

Schedule:

Mon., March 20th, 8:00 am
- Pre-assessment due in D's mailbox

Thurs., March 23rd/Fri., March 24th
- Stage I Training

Thurs., 23rd - Michelle		Fri., 24th - Suzannah	
8:00-10:00	B	8:00-10:00	F
10:00-12:00	E	10:00-12:00	C
12:30-2:30	D	12:30-2:30	A

Wed., March 29th/Thurs., March 30th
- Stage I assessment (Review of Phase I if needed)
- Stage II Training
- Introduce Stage III* Training

Wed., 29th - Suzannah		Thurs., 30th - Michelle	
8:00-10:00	F	8:00-10:00	B
10:00-12:00	C	10:00-12:00	E
12:30-2:30	A	12:30-2:30	D

Week of April 3rd
- After school meetings with teachers to do Stage II assessment, distribute summative assessment of training, and provide additional resources for future exploration.

Fri., April 7th
- Summative Assessment due in D's mailbox by 3:30 pm.

***Stage III will be for those teachers who advance beyond Stage II within the allotted period of time.**